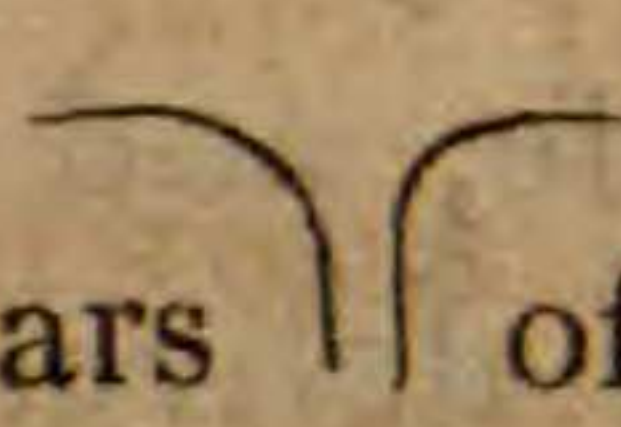
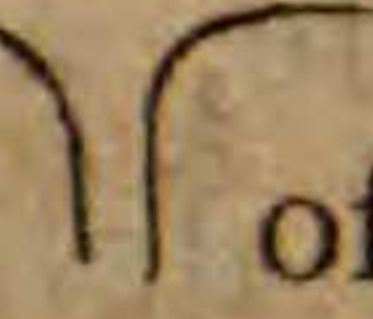

III. *Some Account of the Pitch-lake in the Island of Trinidad, in two Letters: The first from Samuel Span, Esq. to James Tobin, Esq. F. L. S.; and the other from Mr. Tobin to Charles Hatchett, Esq. F. R. S. & L. S.; with Observations by Mr. Hatchett.*

Read April 17, 1804.

St. Vincent, April 2, 1801.

DEAR SIR,

SINCE my last of the 10th ult. I have been down to *Trinidad*, where I devoted one day to the *pitch-lake*, to procure from thence the different specimens you wished for. They are on board the *Union-Island*, and I hope will arrive safe, and in good order. I have packed them in two barrels, and delivered them to the care of the captain for you. The first consists of pebbles picked up from the landing-place on the beach, and pieces broken from the rocks on the sea-coast, partly below the surface of the sea, and partly from the same rocks above high-water mark; *but the whole appears to be of the same nature with that of the lake.* The other barrel contains, in separate parcels—a kind of pitch-cinder, which is found in great abundance on the borders of the lake—firm pitch from one side of the lake—pitch from the body of the lake—and pitch taken from the crater of a tumulus rising about two feet above the level of the ground around it, and distant from the lake about a hundred yards: this last is by much the freshest, and indeed appeared but just thrown up, and consists of about half of the whole quantity in this spot, above

the ground within the crater. This lake is situated about a mile from the gulf, on an eminence, as I conceive, of from eighty to one hundred feet above the level of the sea. It is surrounded on all sides by high woods, except where it has been cleared for the cultivation of the sugar-cane; and in those places the soil has universally proved very fertile. It is the highest land in that quarter of the island. The lake is about a mile across, intersected every where by streams of pure, clear water, which abound with small fish. In many places, even in the centre of the lake, on the solid pitch, are spots having the appearance of so many islands, on which grow plants and shrubs of various kinds: among the rest is the wild pine-apple, or the pine in its natural state, in great abundance. Of this latter I have sent home a few plants to Mr. Edwards, who desired me, previous to my departure, to procure and forward him different kinds of pine plants from these islands. The banks of the rivulets are semi-circular, thus  terminating at bottom in a crevice. The water appears  of various depths, from *two* to *ten* feet; and the channels are continually fluctuating: one of eight or ten feet to-day, may tomorrow be entirely closed up, and others formed where yesterday was a solid mass of pitch. From this it appears, that the pitch itself is supported by a lake of water underneath; but what the thickness or substance of the pitch may be, I can form no idea of. It has, however, evidently been the effect of subterraneous fire. I have been informed that the country on the sea-coast to windward of the lake abounds with *coal*; but I could not collect any information how far these veins extend towards the lake; nor have I ever seen any specimens of this coal.

Dr. Anderson, the superintendant of the botanical garden in St. Vincent, who accompanied me on this expedition, wrote an
account

account of this lake about twelve years ago, which was soon afterwards printed: I do not recollect how it made its appearance, but I think it was in the *European Magazine*:—it is, I believe, the only account of it ever published.

To make use of this pitch, it is necessary to boil it down with one tenth of oil or tallow.

I remain, dear sir, &c. &c.

S. SPAN.

To James Tobin, Esq.

Bristol.

Bristol, Dec. 14, 1801.

DEAR SIR,

THE foregoing is a copy of a letter which I have received from an intelligent friend who has lately made a considerable purchase in the island of Trinidad. It may serve to furnish you with a tolerable idea of the very singular spot, known by the English inhabitants of that large and valuable island by the name of the *Pitch-lake*. I have accompanied this letter with some pieces of the mineral bitumen mentioned in it: they are not, however, the identical specimens therein alluded to (which unfortunately fell into the hands of the Spaniards, by the capture of the ship they were on board of), but others, which Mr. Span collected at the same time, although he did not take the same pains to discriminate them. I have been more immediately induced to trouble you with this communication, as it appears from your very interesting paper in the 4th volume of the *Linnean Transactions*, that you have bestowed a more than ordinary attention on this particular branch of mineralogy.

I do not feel myself by any means qualified to enter the lists with those naturalists who consider all bituminous substances as
originating

originating from organized bodies, once possessed of animal or vegetable life; yet I have no doubt, but the discovery of such an extensive mass of bituminous matter existing in one of our own colonies, situated so near the equator, will contribute, in due time, to throw much additional light on a question of much importance in the natural history of our globe.

From subsequent intelligence which I have procured on the subject, I learn—that this lake (as it is called) is about three or four miles in circumference—that the water which intersects it sometimes forms small pools, as well as rills—that the immediate substratum of all the lands around it, to an unascertained distance, consists of the same bituminous substances, with a covering of from two to four feet thick, of good vegetable mould—that this bitumen runs under its coat of earth, from the borders of the lake to the sea, which in some places is above half a mile, and extends to an unknown distance under the ocean—that the cliffs forming the shore of this part of the gulf, which in some places appear in abrupt precipices, from fifty to a hundred feet high, are composed entirely of this bituminous mineral, in a hard, compact state, but covered with a stratum of earth unequally thick—that, notwithstanding the general opinion of the country gives a volcanic origin to this immense body of bituminous matter, no symptoms of heat are perceptible in any part of the lake; not even in the hollows of the small tumuli (improperly called craters), where this substance seems to have been recently thrown up: nor does there appear to be any thing like scoriæ, or cinders, among the specimens which I have hitherto received.

Under an idea that this information, defective as it is, may prove acceptable to you, until a regular and quiet possession of this newly acquired island will furnish better opportunities to future

ture naturalists of examining so remarkable and interesting a place, with proper leisure and attention,

I remain, dear sir, your most obedient servant,

J. TOBIN.

Charles Hatchett, Esq.

Observations by Mr. Hatchett.

FROM the preceding letters, as well as from the account published by Dr. Anderson in the Philosophical Transactions for 1789, we learn, that the lake of bitumen in the island of Trinidad (known by the name of the Pitch- or Tar-lake, and called by the French La Bray) is of considerable extent, and of an unknown depth*. Moreover, it appears that the general mass which forms this lake has been hitherto considered as simple bitumen more or less indurated. Dr. Anderson, however, observes, that he “could make no impression on its surface without an axe, although at the depth of a foot he found it a little softer, with an oily appearance, in small cells†.” This degree of hardness certainly seems much more considerable than that of the unmixed indurated bitumens, and naturally leads to a suspicion, that the greater part of the bituminous mass in Trinidad is not (as has been supposed) simple mineral pitch or asphaltum.

Upon examining the specimens which Mr. Tobin had obligingly sent to me, I found many of them very hard and difficult to break; and when broken, they did not exhibit the lustre nor the conchoidal fracture of the simple bitumens. The remaining specimens also, although easily broken, possessed still less of the

* Philosophical Transactions, 1789, p. 67.

† Ibid. p. 67.

pure bituminous characters; for their fracture was earthy, and resembled some of the softer kinds of argillo-ferruginous stones.

The specific gravity, likewise, of these specimens is much superior to that of the unmixed bitumens: two examples will be sufficient:—the specific gravity of the solid dark brown compact bitumen from Trinidad is 1,744, at temperature 65° of Fahrenheit, and that of one of the pale brown earthy specimens is 1,336;—on the contrary, the specific gravity of asphaltum is from 1,023, to 1,104, or 1,165: so that between the first sort and asphaltum (if we take 1,104 for the specific gravity) the difference is ,640; and between the second sort and asphaltum, the difference is ,232.

But even few of the mixed or impure bitumens are of so great a specific gravity; for that of the heaviest of the coals noticed by Mr. Kirwan is 1,426*:—he mentions indeed a spurious coal, the specific gravity of which, he says, is from 1,500 to 1,600, and also a specimen of maltha of the specific gravity of 2,070: but this, from his own account, evidently is a limestone impregnated with bitumen; for a specimen examined by him only yielded 14 per cent. of bitumen, the remainder being “calcareous stone†.”

The extraordinary hardness, the specific gravity, and in some measure the general external characters of the specimens which I had received from Mr. Tobin, induced me therefore to believe, that they did not merely consist of mineral pitch, or asphaltum; not but that I had seen others sent from Trinidad, which completely exhibited the various gradations from petroleum to asphaltum; but the characters of the specimens in question were different, and I therefore subjected them to a chemical examination.

* Elements of Mineralogy, vol. ii. p. 53.

† Ibid. vol. ii. p. 46.

When the dark-brown compact sort was distilled until the bulb of the retort was red hot, the fragments retained their figure;—the same also took place if a piece was kept in a red heat for some time in an open crucible. 250 grains of the original substance thus lost 81 grains, = 32,40 per cent., the greatest part of which was bitumen; and when the pale-brown earthy sort was subjected to the same process, the loss on 250 grains was 91, = 36,40 per cent.;—so that the first left a residuum of 169 grains, and the second 159 grains. This residuum, or stone, was spongy, and easily broken;—in an open fire it assumed an ochraceous appearance, but was internally black, in consequence of the coal resulting from the decomposed bitumen. The stone in both cases was similar, excepting that the first sort was more compact;—100 parts of it afforded

Silica	-	-	-	-	-	-	-	-	-	-	60
Alumina	-	-	-	-	-	-	-	-	-	-	19
Oxide of iron	-	-	-	-	-	-	-	-	-	-	10
Carbonaceous matter, by estimation,	-	-	-	-	-	-	-	-	-	-	11
											<hr/>
											100

I did not, however, repeat the analysis, and therefore shall not state the proportions of the alumina and oxide of iron as exact; but this, in the present case, is not of much importance, as the general nature of the stone was only required to be ascertained. Not the smallest trace of lime could be discovered; so that the stone which is thus impregnated with bitumen is totally different from the bituminous limestones, and such-like substances, which have been heretofore noticed.

The true external characters of this stone must, however, still remain in some degree uncertain, until specimens can be procured which either are unmixed with bitumen, or at least are

only partially impregnated with it: but, as a conjecture, I shall venture to say, that I suspect it to be of the nature of the stone which is found with bitumen in Auvergne, and which is called by Born “a grayish compact lava*.”

The analysis of the stone of Trinidad which remains after the separation of the bitumen, accords with the prevalent soil of the island; for Dr. Anderson states that “the soil in general, for some distance round La Bray, is cinders and burned earths; and where not so, it is a strong *argillaceous soil*.” p. 69. In the latter part of the same page he also says, “From every examination I have made, I find the whole island formed of an argillaceous earth, either in its primitive state, (by which he probably means common clay,) or under its different metamorphoses. The bases of the mountains are composed of *Schistus argillaceus* and *Talcum lithomargo*.” In almost all the species of the argillaceous genus, silica is known to predominate; and the stone impregnated with bitumen, which has been mentioned, evidently appertains to that genus, so as in some measure to approach the nature, but not the texture, of the bituminous slates. It is, however, remarkable, that in the more compact specimens of this substance the bitumen so completely disguises the character of the stone, that it may easily be, and indeed has been taken for a variety of asphaltum.

I have already stated, that I have seen specimens from Trinidad which exhibited the various gradations of petroleum into real asphaltum; and from Dr. Anderson's account, the liquid bitumen or petroleum is occasionally found†: but this, as well

* Catalogue de la Collection des Fossiles de Mademoiselle de Raab, tome ii. p. 77.

† “Besides this place (La Bray) where it is found in this solid state, it is found liquid in many parts of the woods; and at the distance of twenty miles from this, about two inches thick, in round holes of three or four inches diameter, and often at cracks or rents.

as the asphaltum, most probably occurs only in certain fissures and cavities; for, from the specimens noticed in the present paper, there is great reason to believe that a considerable part of that mass in Trinidad, which has been hitherto supposed to be pure mineral pitch or asphaltum, is in reality only a porous stone of the argillaceous genus, much impregnated with bitumen*.

rents. This is constantly liquid, and smells stronger of tar than when indurated, and adheres strongly to any thing it touches; grease is the only thing that will divest the hands of it." Philosophical Transactions, 1789, p. 68.

* Having acquainted Mr. Tobin with the result of my experiments, that gentleman in his answer observes, "I have indeed lately had reason to suppose that it could not be a perfect bitumen, from having been assured that it is made use of as a material for pavements, and that it bears exposure to the heat of a tropical sun."